Preliminary

The Effect of Medicare Managed Care on Medical Care Utilization by the Elderly

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Abstract

The effect of managed care on the utilization of medical care by the elderly is examined by exploiting the variation across states in the growth in Medicare managed care. This growth almost doubled the percentage of Medicare beneficiaries enrolled in managed care between 1989 and 1994. The use of both the Medicare managed care penetration rate and individual-level HMO coverage status allows for the disentangling of market-level and individual-level effects.

Both the Medicare managed care penetration rate as well as individual HMO coverage are found to have positive and significant effects on both the number of recent doctor visits as well as on the probability of having had any doctor visits in the last year. Some evidence is found that suggests Medicare managed care reduces the percentage of visits to specialists. In addition, seniors with HMO coverage were found to have lower numbers of hospital days. This result was confirmed using county level data which may be freer of measurement error and omitted variables bias than individual data. Poor seniors and those with chronic conditions were found to have benefited less from gains in utilization than the rest of the elderly population. The results suggest that the growth of Medicare managed care has increased the usage of outpatient services and decreased the usage of inpatient and specialist services and that these effects have spilled over to influence medical care utilization for all seniors.

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A managed care plan is one in which the overall care of a patient is overseen by a single provider or organization (Congressional Research Service, 1993). For example, in a Health Maintenance Organization (HMO), the organization receives a fixed periodic payment, known as a capitation payment or premium, and in return accepts financial responsibility for all covered medical expenses. In order to receive reimbursement, the patient is obligated to receive care only through the HMO or through referrals from it. The treatments recommended by doctors may be subject to utilization review. HMOs may also use financial or other incentives to influence doctors' decisions.

Medicare is currently the second largest government program in terms of spending, and, given the aging of the population, is expected to continue growing (Economic Report of the President, 1998). Voters have increasingly voiced concern about the financial soundness of Medicare with 73 percent of voters ranking it high on a list of political priorities (Henry J. Kaiser Foundation, 1999). Managed care has been seen as a possible solution to ever-rising Medicare expenditures. Indeed, the growth of managed care has been found to have played a role in slowing the growth of medical expenses in recent years (Cutler and Sheiner, 1998). In 1982, Congress passed legislation (TEFRA ’82) making it easier for health insurers to provide managed care plans to the elderly, and the Health Care Financing Administration (HCFA) has encouraged the proliferation of managed care options for the elderly population.

The number of Medicare beneficiaries enrolled in managed care has grown rapidly in recent years: from 1,842,554 in 1989 to 5,895,227 in 1997 (HCFA, 1999). This represents an increase of over 400%. As a percentage of Medicare beneficiaries, Medicare managed care enrollees have increased from 4.5 percent to 18 percent from

1989 to 1998 (HCFA, 1999). This rapid growth has paralleled the penetration of managed care throughout the population. In 1989, 17.7 percent of the population was enrolled in a managed care plan (author's tabulations from the National Health Interview Survey, 1989). By 1997, this had grown to 41.6 percent (author's tabulations from the Medical Expenditure Panel Survey, 1999).

Medicare managed care differs from traditional fee-for-service Medicare in several respects. First, Medicare HMO enrollees are subject to the features described above as pertaining to managed care in general, including utilization review and a limited choice of providers. Second, Medicare HMOs often cover things not covered by fee-for-service Medicare such as prescription drugs as well as vision, and dental care. These are typically provided at little or no extra cost to the patient.

The increasing dominance of managed care as the primary model of health care delivery has not occurred without controversy. A so-called HMO backlash has been spawned by numerous media reports of negligence or abuse by HMOs reported in the media. This backlash has catapulted regulation of managed care to the top of the national political agenda. A poll taken by the Henry J. Kaiser Foundation in late 1998 showed that 78% of voters support so-called patients' rights legislation (Henry J. Kaiser Foundation, 1999). This legislation would “require HMOs and other managed care plans to provide people with more information about their plan, make it easier to see medical specialists, allow appeals to independent reviewers, and give people the right to sue their health plan” (Henry J. Kaiser Foundation, 1999).

This paper exploits variation in state and county level growth of Medicare managed care to address the effect of Medicare managed care on the health insurance

coverage of the elderly and on their utilization of medical care. The paper differs from previous studies of Medicare managed care in several respects. First, this study employs both individual HMO coverage status and market level Medicare managed care penetration, thereby allowing for the disentangling of individual and overall market effects of managed care on medical care utilization by the elderly. Previous studies either looked at the effect of individual HMO coverage on medical care utilization or have looked at the effect of managed care penetration on medical care expenditures. Second, this study uses a national survey on individual level health insurance coverage and medical care utilization, the National Health Interview Survey (NHIS), rather than focusing on the effects of a particular plan. This approach of examining the overall effect of Medicare managed care may be useful to policy-makers. Third, this study employs county level data on medical care utilization from the Area Resource File to confirm some of the results found using individual level data.

This study shows that individual HMO coverage as well as Medicare managed care penetration affect medical care utilization for seniors. Individual HMO coverage and Medicare managed care are found to increase the usage of outpatient services, and individual HMO coverage is found to decrease the number of days spent in hospital.

Section II of the paper provides background on Medicare managed care and its potential effects on health insurance coverage and medical care utilization. Section III describes the data sets employed. Section IV delineates the empirical strategy, Section V discusses results, and Section VI reviews the conclusions.

II. Background

II.A. Positive selection

Previous studies provide evidence of positive selection into Medicare managed care plans and adverse selection into traditional fee-for-service Medicare. In a review of previous literature on selection bias and HMOs, Hellinger (1995) concludes that seniors who enroll in HMOs tend to be healthier. Seniors with a history of illness appear to be less likely to change their provider, as might be required by enrolling in an HMO (Hellinger, 1995). Hellinger' (1995) conclusions, however, are based on a relatively small number of studies. Morgan et al. (1997) find that "Medicare beneficiaries who enroll in HMOs tend to be healthier than those who remain in the fee-for-service system" and that those who disenroll from HMOs tend to be less healthy than those who remain. Morgan et al. (1997) find that disenrollees have a substantially higher rate of hospital admissions than did fee-for-service beneficiaries. In addition, Hill and Brown (1990, 1992) find lower Medicare reimbursements (lower utilization) and better health status among the elderly prior to their enrolling in an HMO.

The positive selection of healthier beneficiaries into Medicare HMOs is exacerbated by their enrollment policies (Altman and Wilensky, 1995). Enrollment in Medicare HMOs is voluntary, and all Medicare beneficiaries who are covered by Part B (outpatient services) may enroll in a Medicare HMO if they live within the plan's service area (Altman and Wilensky, 1995). Medicare HMO enrollees may disenroll from their HMO at any time for any reason (Altman and Wilensky, 1995). The ease of enrollment and disenrollment into and out of Medicare HMOs has lead to a relatively high turnover

rate. In 1993, 18 percent of those who enrolled in a Medicare HMO at the beginning of the year had left that plan by the end of the year (Altman and Wilensky, 1995), although many of these simply switched plans.

The potential for healthier Medicare beneficiaries to positively select HMO coverage has repercussions for this study. One would expect healthier beneficiaries to have lower utilization rates thereby possibly biasing downward estimates of the effect of managed care on medical care utilization.

II.B. Cream-skimming

Since managed care organizations are paid a fixed capitation rate per Medicare enrollee, they have an incentive to "cream-skim" healthier enrollees (Newhouse, 1982). Legally, Medicare HMO plans are not allowed to turn away potential enrollees on the basis of their health status (HCFA, 1999). They can, however, send signals to their desired enrollee through advertising. For example, in a survey of the advertising of Medicare managed care plans, the Kaiser Family Foundation found that they typically portrayed active, healthy seniors (CNN, 1998). In addition, one third of marketing seminars were not wheelchair accessible and many newspaper advertisements placed important information in such fine print that even researchers had difficulty reading it (CNN, 1998).

As with positive selection, cream-skimming by HMOs should result in Medicare HMO enrollees' being healthier than fee-for-service beneficiaries. This could bias estimates of the effect of managed care on medical utilization downward.

II.C. The effect of individual HMO coverage on utilization

Medicare managed care enrollees are typically charged small or no co-payments for doctor visits. For example, a typical co-payment is often around $5. Medicare fee-for-service Part B beneficiaries (without Medigap coverage) must pay a yearly deductible of $100 as well co-insurance of 20% of the cost of the doctor visit (HCFA, 1999). The marginal cost of a doctor visit may therefore be lower for Medicare managed care enrollees. Medicare managed care organizations, however, may limit access to specialists whereas fee-for-service Medicare Part B coverage allows beneficiaries to visit the doctor of their choice. Medicare managed care plans also typically offer additional services to their enrollees for no additional charge or for a small co-payment. For example, many Medicare managed care plans charge their enrollees a small, fixed rate (say $5) per prescription. Given the lower marginal cost of doctor visits for Medicare HMO enrollees, economic theory predicts that they should have a larger number of doctor visits overall. In addition, given the lack of a yearly deductible for Medicare HMO enrollees, economic theory predicts that they may be more likely to have had at least one doctor visit annually.

Miller and Luft (1994) found that Medicare HMO enrollees had higher numbers of physician office visits while Brown et al (1993) found slight decreases in the number of doctor visits for Medicare HMO enrollees. Both Miller and Luft (1994) and Brown et al. (1993) found overall that HMO enrollees consistently received more preventive care; however, given the relatively high turnover among Medicare HMO enrollees, one would expect that HMOs' incentives to offer preventive care would be muted. In addition, Brown et al. (1993) find that Medicare HMO enrollees were more likely to have had at

least one doctor visit in the last year versus Medicare fee-for-service beneficiaries. Miller and Luft (1994) point out that their results may be biased due to insufficient adjustment for the favorable selection of healthier patients into HMOs. In addition, there may also have been favorable selection of the HMOs participating in the studies (Miller and Luft, 1994).

Given the costliness of hospitalization, one may expect cost-conscious Medicare HMOs to try to reduce both hospitalization rates as well as hospital length of stays for their beneficiaries. Although hospitals face similar incentives for both types of patients due to Medicare's Prospective Payment System (PPS), doctors can coordinate care for managed care patients thus reducing their lengths of stay (Brown et al., 1993). Miller and Luft (1994) found that Medicare HMO enrollees had only a small and statistically insignificant difference in hospital admission rates versus fee-for-service beneficiaries. Brown et al. (1993), however, found no difference in hospitalization rates between the two groups. Both Miller and Luft (1994) and Brown et al. (1993) found reduced lengths of stay for Medicare HMO enrollees. Brown et al. (1993) attribute reduced lengths of stay to HMOs' better coordination of care; however, this may be due, at least in part, to the positive selection of health beneficiaries into Medicare HMOs.

II.D. Effects for those with Chronic Conditions and Low-Incomes

Previous literature reveals that elderly persons who are in poor health and/or have chronic conditions may be more greatly affected by managed care than the rest of the elderly population (Miller, 1998). In addition, elderly persons in poor health may be subject to cream-skimming by HMOs.

Clement et al. (1994) find mixed results regarding medical care utilization for Medicare HMO enrollees with chest and join pain compared to similar Medicare fee-for-service enrollees. The Medicare HMO enrollees were more likely to have had at least one physician visit; however, they were also less likely to be referred to a specialist. Medicare HMO enrollees were less likely to show a symptomatic improvement in their condition than were fee-for-service beneficiaries. Hill et al. (1992) find that Medicare HMO enrollees in worse health are subject to larger utilization reductions versus fee-for-service enrollees than are Medicare HMO enrollees in comparatively better health. Hill et al. (1992) find that HMO enrollees in poor health had fewer hospital days, fewer home nurse visits, and fewer home aide visits compared to fee-for-service enrollees in similar health. HMO enrollees are found, however, to have higher rates of hospital admissions.

Low-income HMO enrollees, like HMO enrollees with chronic conditions, may also be more greatly affected by managed care than other enrollees (Miller, 1998). However, in contrast to those with chronic conditions, low-income HMO enrollees have been found to have higher rates of medical care utilization (Mark and Mueller, 1996). Mark and Mueller (1996) find that low-income HMO enrollees were more likely to have had at least one physician visit and had more physician visits overall than did fee-for-services enrollees.

The different effects that managed care may have on medical care utilization for those with low incomes or chronic conditions suggest examining effects for these groups separately as will be done in this study.

II.E. The effect of managed care penetration on medical care utilization

The growth of Medicare managed care may effect medical care utilization not only for Medicare HMO enrollees but also for Medicare fee-for-service beneficiaries. Baker (1995) finds that expenditures for fee-for-service Medicare beneficiaries are decreasing at overall HMO market shares exceeding 18% (Baker, 1995). In addition, increases in the Medicare managed care penetration rate are associated with increases in Part A (inpatient) expenditures and a small decrease in Part B (outpatient) expenditures for Medicare fee-for-service beneficiaries (Baker and Shankarkumar, 1997).

HMOs often impose utilization constraints, which may affect the quantity of medical care provided not only to managed care patients but throughout the market by increasing market discipline (Baker, 1995). In order to improve efficiency and better compete with HMOs, non-HMO providers or insurers may also institute utilization review or change the way they provide care in the interest of efficiency gain (Baker, 1995). In addition, since local and not national patterns of practice are the standard against which physician negligence is determined, increasing HMO penetration in an area may be expected to have market-wide effects on physician practice patterns (Phelps, 1992).

HMOs may also cause hospitals to act more competitively. For example, hospitals are increasingly forced to bid for contracts with HMOs (Noether, 1988). Chernew (1995) finds that increases in HMO penetration are associated with declines in hospital size. In addition, Goldberg and Greenberg (1977) find that increased HMO market share is associated with reduced use of hospital services.

Managed care may further influence medical care utilization through various other means. Since managed care aggressively competes with traditional providers and

insurers in terms of price, one would expect HMO entry to have market price effects (Noether, 1988). Since Medicare reimburses fee-for-service physicians based on the "usual, customary, and reasonable charges" for similar services performed by the physician and other physicians in the area, increased price competition from HMOs will affect the reimbursement rates market-wide (Baker, 1995; Baker, 1997). Studies have also found that HMO penetration affects the availability of high-tech medical technology, the number of providers, the distribution of generalist versus specialist physicians, the locating decision of providers, and the overall level of coverage provided by insurers in a given area (Baker, 1995; Baker and Spetz, 1999; Baker, 1997; Christianson and McClure, 1979; Goldberg and Greenberg, 1980).

All of the market level changes mentioned may be expected first to influence medical care utilization for both Medicare HMO enrollees and Medicare fee-for-service beneficiaries. This implies the need to look at individual HMO coverage as well as HMO market penetration when examining the effect of managed care on medical care utilization; this is a key innovation of this study. Also, these changes imply that it will be necessary to control for the growth of private sector managed care so that its effects on health care markets will not be erroneously attributed to Medicare HMOs.

III. Data Documentation

Two primary data sets will be employed in this study. The first is the National Health Interview Survey (NHIS) which provides information on medical care utilization, demographics, and health insurance status on an individual level. The second is the Area Resource File which provides information on medical care utilization, demographics, and providers at a county level. County level data will be employed because it may be freer of the problems of measurement error and selectivity to which individual level data may be subject.

III.A. The National Health Interview Survey

The National Health Interview Survey (NHIS) is an annual nationally representative survey of American families on health issues. The main portion of the survey consists of cross-sectional data on demographic characteristics, labor force attachment, family income and the utilization of medical care for approximately 120,000 individuals each year of which around 11,000 are senior citizens. The National Health Interview Survey periodically includes a Health Insurance Supplement, which contains data on the type of health insurance coverage (Medicare, Medicaid, military/CHAMPUS/CHAMP-VA, public assistance, private insurance), characteristics of private insurance, and individual coverage status.

The NHIS provides geographic data at the state level, however, state identifiers for the health insurance supplements of the NHIS are only available for the years 1989, 1992, 1993, and 1994. Since these identifiers are necessary in order to merge in data on

Medicare managed care enrollment data from HCFA this study will be limited to these four years. In 1993 the Health Insurance Supplement was administered to only half of the survey participants so that the four years of data available contain information on approximately 40,000 elderly people.

Market-level data on Medicare managed care penetration will be merged into the NHIS data on a year-state basis. The Medicare managed care penetration rate, which will be called $MMCO_{st}$, is the percentage of the state's Medicare population enrolled in a managed care plan during each year of the study. These data come from the Health Care Financing Administration's (HCFA's) annual Managed Care Contract Report for the Medicare program. Since these administrative data are gathered and published directly by HCFA about its beneficiaries, they should be relatively free of measurement error.

The Medicare managed care penetration rate exhibits a great deal of variation over time and between states during the period of this study. Table 1 provides Medicare managed care penetration rates by state for the years of this study. For example, in 1994, the Medicare managed care penetration rate was 31.1 percent in California, whereas it was zero in thirteen states in that year. More importantly, the rates of growth of Medicare managed care vary widely among the states. For example, California and New York added an additional 13 percent and 2 percent of their Medicare populations, respectively, over the period 1989 to 1994.

The NHIS health insurance supplements contain data on whether the individual receives health insurance coverage through a health maintenance organization (HMO). Unfortunately, the NHIS health insurance supplement does not contain a specific question about Medicare HMO coverage. The NHIS does, however, contain data on

individual private insurance plans held, for up to 4 different plans, and whether these are managed care plans. In this paper, it will be assumed that Medicare beneficiaries who have managed care coverage for their first listed plan are Medicare HMO enrollees. This variable, $HMOCOV_i$, when summed to the state level has a correlation of .88 with $MMCO_{st}$ and therefore is a reasonable indicator of Medicare HMO coverage.

In order to account for potential spillovers from the private managed care market onto the Medicare managed care market, one may want to include a control variable for private managed care penetration. However, this variable was not significant in any of the utilization estimations and did not affect the results for individual HMO coverage or for the Medicare managed care penetration rate. It will therefore not be included in the estimations shown here.

The utilization measures provided by the NHIS consist of the number of doctor visits, the number of hospital visits, and the number of days spent in hospital. The number of doctor visits is reported both for the preceding year and in the previous two weeks.

Six utilization measures will be used in the estimation models. First, a variable is constructed that is equal to one if the senior had no doctor visits in the last year. The American Cancer Society recommends seniors receive a cancer screening annually (American Cancer Society, 1999), so that the absence of any doctor visits in the past year would indicate that seniors are not receiving recommended preventive care. The absence of visits may, therefore, be more directly linked to health outcomes than the total number of visits.

The second measure is the log of the number of doctor visits in the past 12 months, given the individual had any doctor visits. The number of doctor visits is of interest because it has a direct impact on the medical care expenses. It is more difficult to link the number of doctor visits with health outcomes, however. A greater number of doctor visits may be indicative of either better access to medical care or a decrease in health status. The distribution of the number of doctor visits is very skewed, with some seniors receiving very large numbers of doctor visits. This problem will be addressed by focusing on the log of the number of doctor visits in the regression models (in order to make the dependent variable more normally distributed).

As a third measure, a variable is constructed that is equal to one for having had any doctor visit in the last two weeks. This variable may be freer of recall (measurement) error than the number of doctor visits in the last twelve months. This measure as well may be indicative of the frequency of contacts.

A fourth measure is constructed for the percentage of doctor visits in the last two weeks which were to specialists. The NHIS asks participants what kind of provider, such as general practitioner, specialist or other medical personnel, they met for their recent doctor visits. Since not all participants were asked about specialist visits, regressions on the percentage of specialist visits have a smaller number of observations than those for the other utilization measures. Because HMOs often force enrollees to go through gatekeepers and/or to receive referrals in order to receive reimbursement for seeing a specialist, one might expect HMO enrollees to have a lower percentage of doctor visits to specialists. On the other hand, a diminished percentage of visits to specialists for HMO enrollees may be indicative of the positive selection of healthier enrollees into Medicare

HMOs. Given that a reduction in specialist visits may reduce the supply of specialists, county level data from the Area Resource File on the number of specialists per capita will be used to test the results for the percentage of specialist visits.

As a fifth measure, a variable is constructed that is equal to one for having been hospitalized in the last year. Hospitalizations are of interest because of their large and direct impact on medical care costs. The link between hospitalizations and health outcomes is less clear, however. A greater number of hospitalizations or lengthier hospital stays may indicate greater access to expensive procedures and specialists. A greater number of hospitalizations may also indicate that an illness was not detected in its early stage and was allowed to worsen, thus indicating a lack of sufficient preventive care. For example, heart failure is the most common cause of hospitalization for the elderly; however, heart disease increasingly can be managed by proper monitoring and medication.[1] On the other hand, a reduced probability of having been hospitalized in the last year may be indicative of the utilization review aspects of managed care. It is therefore ambiguous as to the meaning of an increased probability of hospitalization for the overall quality of medical care.

A sixth measure is the number of days hospitalized in the last year given the individual had any hospitalizations. The number of hospital days has a direct impact on medical care costs. As in the case of hospitalizations, the link between hospital days and health outcomes is not clear. Lengthier hospital stays may be indicative either of more severe illness, which may be the result of insufficient preventive care, or of greater access to expensive procedures. Shorter hospital stays may result from more stringent

[1] The most common causes of hospitalization for the elderly are heart failure, pneumonia, cerebrovascular disorders, pulmonary disease, and limb and joint reattachment.

utilization review. As in the case of doctor visits, logs are taken of the number of days hospitalized in the last year because of their skewed distribution.

Table 2 provides descriptive statistics for the entire sample, for those with HMO coverage, for those with chronic conditions, and for those with household incomes below the poverty line. Table 2 gives descriptive statistics for medical care utilization, health insurance coverage, and health status. Table 2 shows that seniors with Medicare HMO coverage have lower numbers of doctor visits in the last year than do all seniors; however, they also have a lower probability of not having had a doctor visit in the previous year. This may indicate improved access to medical care. Surprisingly, Medicare HMO enrollees do not have a greatly reduced percentage of their doctor visits to specialists. Medicare HMO enrollees have a lower probability of having been hospitalized in the last year as well as lower numbers of hospital days. These differences may be due to the factors discussed above or to the positive selection of healthier patients into HMOs. For example, in comparison with the entire sample, HMO enrollees have a lower probability of having a chronic condition. They are also less likely to report having an activity limitation, are more likely to report their health status as being excellent or very good, and are less likely to report their health status are being fair or poor. HMO enrollees are more likely to report having mid-range household incomes; that is, they are over-represented among seniors with incomes from $10,000 to $30,000 per year. This may indicate that HMO enrollees are less likely to be poor and in poor health, in which case they would qualify for Medicaid, and are less likely to have high incomes, in which case they could substitute a supplemental Medigap policy for HMO coverage.

Chronic conditions are extremely common among the elderly with 68% of the NHIS sample reporting some kind of condition.[2] The most common chronic conditions reported are arthritis, hypertension, diabetes, ischemic heart disease, and hearing impairment. Seniors with chronic conditions report a greater utilization of medical care in terms of the number of doctor visits, the probability of having been hospitalized in the last year, and the number days spent hospitalized in the last year. As one might expect, seniors with chronic conditions also are more likely to have an activity limitation and to report their health status as being fair or poor versus the entire sample.

While seniors with incomes below the poverty line report a greater than average number of doctor visits in the last year, a higher than average percentage of them report having had no doctor visits in the last year. The higher overall number of doctor visit for this group reflects their relatively poor health. They are much more likely to have a chronic condition than the entire sample: 76.5 percent of those below poverty have a chronic condition versus 68.2 percent of the entire sample. The combination of poor health and poverty is also reflected in the much higher percentage of this group with both Medicare and Medicaid coverage: 27.3 percent of seniors with incomes below the poverty line have both Medicare and Medicaid coverage versus 5.8 percent for the entire sample.

Table 2 shows that seniors with Medicare HMO coverage are more likely to be white, more likely to be college educated and less likely to be a high school dropout, and more likely to live in a central city than the entire sample. In addition, Medicare HMO

[2] Respondents were asked to describe any existing health conditions to the interviewer, and to say how long they had had the condition. Interviewers are instructed to consider a health problem of any kind as a "condition". On the basis of the respondent's description, the interviewer codes the type of condition as well as whether it was acute or chronic.

enrollees are less likely to be poor and are more likely to have household incomes between $10,000 and $30,000 per year. Seniors with chronic conditions appear similar to the entire sample, but are slightly more likely to be poor. Poor seniors are much more likely to be female, black or Hispanic, to have smaller families, and to live in the central city than the entire sample. All of the demographic and economic status variables listed in Table 2 will be controlled for in the regression models reported below.

III.B. The Area Resource File

The Area Resource File (ARF) is an annually updated data set containing information on medical care providers as well as medical care expenditures and utilization at the county level. The utilization measures in the ARF come from the American Hospital Association. In addition, the Area Resource File provides demographic information which come from the Census Bureau. County level data on Medicare managed care penetration from HCFA will be merged with data from the ARF. County level private managed care penetration is calculated using data from Interstudy on HMO enrollment and the county service areas for the HMOs. Since the enrollments are not available by county, individual HMO enrollments are allocated to counties based on county population size.

Since the ARF does not provide data on all of the variables of interest for many years and because HCFA has only released county level managed care penetration going back to 1993, this portion of the study will be limited to the years 1995 and 1996. However, these were years of rapid Medicare managed care growth. From 1995 to 1996,

Medicare managed care penetration increased 22 percent from 10.3 percent to 12.6 percent of Medicare beneficiaries.

This study will employ two utilization measures relevant to the elderly population from the Area Resource File. A first measure is the number of Medicare hospital discharges per Medicare beneficiary. A second measure is the number of Medicare hospital days per Medicare beneficiary. This measure is roughly analogous to the individual measure of hospital days from the NHIS. Both of these utilization measures are constructed at a county level and therefore changes in them due to Medicare managed care penetration may be more reflective of changing practice patterns and less reflective of variations in individual health status than individual hospitalization rates and lengths of stay.

The supply of medical providers may also be affected by the growth of Medicare managed care. In particular, if Medicare HMOs limit or discourage access to specialists one might expect to find lower numbers of specialists practicing in areas with higher Medicare managed care penetration. Several measures of the number of providers will be used. These measures are: the number of specialists per capita, the number of cardiologists per capita and the number of pediatricians per capita. The number of cardiologists per capita will be used because the elderly are more likely to rely upon their services than other specialists. The number of pediatricians per capita will be included as a control: it should not be effected by the growth of Medicare managed care.

Table 3 provides descriptive statistics for the ARF data for the years 1995, 1996, and 1997. The statistics in Table 3 are shown for all counties and for counties which had any Medicare discharges. Counties without any Medicare discharges were counties

without a hospital, and these counties tended to be rural. Administrative data provided by the ARF may be freer of measurement error than the individually reported data from the NHIS. From the ARF, the number of Medicare discharges per Medicare beneficiary is .328 whereas, from the NHIS, the number of hospital discharges per Medicare beneficiary is .235. From the ARF, the number of Medicare hospital days per Medicare beneficiary is 2.45 whereas, from the NHIS, the number of hospital days per Medicare beneficiary is 1.74. The consistently lower utilization figures from the NHIS may reflect the censoring of data for survey participants who died. In addition to the ARF data potentially being freer of measurement error than the NHIS data, estimation on the county level should be less prone to bias due to omitted variables such as unobserved health status. One would not expect there to be significant changes in county-wide health status from year to year.

IV. Estimation Strategy

IV.A. Estimation using the NHIS

As discussed above, Medicare HMOs may effect utilization either directly through individual coverage or indirectly through effects on the market for care. In order to examine both of these effects on utilization ordinary least squares (OLS) is used to estimate equations of the following form for the NHIS data:

$$\begin{aligned} UTIL_i = \alpha + \beta_{j1} HMOCOV_i + \beta_{j2} MMCO_{st} + \\ + \beta_{j3} ChronicC_i + \beta_{j4} Pov_i + \beta_{j5} X_i + \varepsilon_i , \quad (1) \end{aligned}$$

where $UTIL_i$ are the utilization measures mentioned above, $HMOCOV_i$ is individual Medicare HMO coverage. and $MMCO_{st}$ is the Medicare managed care penetration rate. Other control variables account for whether the senior had a chronic condition, $ChronicC_i$, and whether the senior was poor, Pov_i. Matrix X_i contains the demographic and economic status controls listed in Table 2. In addition, Matrix X_i contains dummy variables for state, year, season, and age. The state, year, season, and age dummies control for fixed characteristics of states (such as demographic composition), years (such as overall national economic conditions), as well as seasonal and age effects on utilization.

Several issues surround the use of the variables for individual HMO coverage, $HMOCov_i$, and Medicare managed care market penetration, $MMCO_{st}$. Both of these variables and the utilization measures may be correlated with unobserved variables thus resulting in omitted variables bias. For example, better unobserved health status for the population and/or individual would positively affect individual HMO coverage and Medicare market penetration as well as medical care utilization (Baker, 1995). It seems reasonable to assume, however, that the health status of states' populations will not change greatly over the five-year span of this study. The inclusion of state fixed effects should then adequately control for any omitted variables bias in estimates of the effect of Medicare managed care penetration on utilization. Unobserved individual health status may, however, bias results of the effect of individual HMO coverage on utilization. Since one expects healthier individuals to be more likely to select HMO coverage, OLS estimates of the effect of HMO coverage on utilization may be biased downward. To

verify whether individual health status influences individual HMO coverage, first stage regressions of individual HMO coverage on NHIS indicators of health status (in addition to the other control variables) will be estimated.

A second concern with individual HMO coverage, $HMOCov_i$, and Medicare managed care market penetration, $\%MCO_i$, is that they may be subject to measurement error. This is much less likely to be the case for managed care penetration since these data come directly from HCFA which administers the Medicare program. As mentioned earlier, due to the limitations of the NHIS individual HMO coverage may be measured with some error. As in the case of positive selection, measurement error in individual HMO coverage will bias estimates of the effect of HMO coverage on utilization towards zero. Since both positive selection and measurement error in individual HMO coverage will bias OLS estimates towards zero, positive estimates of the effect of individual HMO coverage on utilization are suggestive of true increases in utilization.

IV.B. Estimation using the ARF

Since ARF data is given on a county level, the effect of Medicare managed care penetration on medical care utilization will be examined. Equations of the following form will be estimated:

$$UTIL_{ct} = \gamma_c + \delta_1 MMCO_{ct} + \delta_2 PMCO_{ct} + \delta_3 X_{ct} + \delta_4 M_{ct} + \varepsilon_{ct}, \qquad (2)$$

where $UTIL_{ct}$ represents the county level utilization measures, $MMCO_{ct}$ represents Medicare managed care penetration, $PMCO_{ct}$ represents private managed care

penetration, X_{ct} is a matrix of county level demographic characteristics, and M_{ct} is a matrix of county level medical system characteristics. An additional dummy variable is added for the year.

OLS estimation of Equation (2) may be subject to omitted variables bias. For example, unobserved health status could influence both utilization as well as the propensity of seniors to enroll in Medicare managed care. Equation (2) will therefore be estimated including fixed effects for the county. Assuming that the omittted variables, such as unobserved health status, are stationary over time at the county level, the inclusion of county fixed effects will eliminate the problem of omitted variables bias.

V. Results

V.A. Results from the NHIS

The potential for managed care organizations to cream-skim healthy Medicare beneficiaries as well as the possibility that healthier Medicare beneficiaries may positively select into managed care plans leads one to believe the enrollees in Medicare managed should be healthier than the general population of Medicare beneficiaries. If this were the case, one would expect that individuals' own appraisal of their health status and reporting of any medical conditions would be relevant to their managed care coverage status.

Table 4 displays the results of regressions of $HMOCOV_i$ and $MMCO_{st}$ on the set of control variables, plus a set of health status variables. Table 4 shows, however, that there is only a weak correlation between reported health status and the managed care

variables. Individuals reporting any kind of limitation to their daily activities are only slightly less likely to have individual HMO coverage as are those who report their health status as being poor. Surprisingly, the presence of a chronic condition does not appear to affect the probability of individual HMO coverage. Individuals who report their health status as being either excellent or very good have a slightly higher probability of living in a state with a higher Medicare managed care penetration rate. Individuals who report their health status as being poor have a slightly lower probability of living in a state with a higher Medicare managed care penetration rate. The results for both individual HMO coverage and the Medicare managed care penetration rate reveal only a small correlation between observed better health status and HMO coverage or living in a state with higher Medicare managed care penetration. In addition, the high correlation coefficient (R^2 = .95) as well as the strong significance of state fixed effects for the estimations for Medicare managed care penetration indicate that time varying omitted variables may not significantly bias OLS results for this variable.

Assuming the NHIS health status variables should capture individual attributes relevant to predicting managed care coverage and given the weak correlation between these variables and the managed care variables lead one to believe that the potential for omitted variables bias may not be great in this case. I therefore proceed to estimate equation (1) using the ordinary least squares model (OLS) for the entire sample. Results for all covariates are in Table 5.

The effects of managed care on utilization by the elderly come both from the Medicare managed care penetration rate and from their individual HMO coverage. Both variables are negatively correlated with the probability of having gone without a doctor

visit in the last year. Having HMO coverage is estimated to decrease the probability of going without a doctor visit by 3.3%. Given that 12.7% of seniors go without any doctor visits, this represents a decrease of 25% in the probability of going without a doctor visit. An increase in the Medicare managed care penetration rate of 14 percentage points, such as that which occurred in the last 10 years, would be expected to decrease the probability of going without a doctor visit by 1.7 percentage points. This is roughly half the magnitude of the decrease in the probability of going without a doctor visit which is due to having HMO coverage. Given that one may expect HMO enrollees to be healthier than the rest of the elderly population, these estimates may understate managed care's positive effect on the probability of having had an doctor visits.

HMO coverage is found to decrease the overall number of doctor visits in the last year. This magnitude is quite small however and is difficult to interpret given that HMO enrollees may be healthier than the rest of the elderly. Both HMO coverage and Medicare managed care penetration are found to increase the probability of having had a recent doctor visit. The variable for recent doctor visits may be freer of recall error than the overall number of doctor visits in the last year. Having HMO coverage increases the probability of having had a recent doctor visit by 1.6 percentage points. Given that 24.3% of the sample report having had any doctor visits in the last two weeks, this represents an increase of 7% in the probability of having had a recent doctor visit. A 14 percentage point increase in the Medicare managed care penetration rate would result in an increase in 3.2 percentage points in the probability of having a recent doctor visit. This represents an increase of 13% in the probability of having a recent doctor visit. Here again, since one may expect that HMO enrollees are healthier the rest of the elderly

population, these estimates may understate the positive effect of managed care on doctor visits.

Individual HMO coverage decreases the percentage of specialist doctor visits. Having HMO coverage decreases the percentage of specialists visits by almost 10% given a mean percentage of specialist visits of .42. This relatively large reduction may not readily be ascribed to a reduced access to specialists, however, since healthier seniors may positively select into Medicare HMOs as well as have a lower demand for specialist services. County level data, which should be freer of selectivity problems, will be used below to verify this result.

Neither individual HMO coverage nor the Medicare managed care penetration rate is found to have any effect on hospitalization rates. However, individual HMO coverage is found to reduce the number of days spent hospitalized, conditional upon hospitalization. HMO coverage is estimated to reduce the number of days hospitalized by 1 day. This estimate is roughly in line with results from a previous study (Brown et al., 1993). Given a mean number of days hospitalized, conditional upon hospitalization, of 10.5 days, the reduction of 1 hospital day for HMO enrollees represents a 10% reduction in hospital days. Given the cost of hospitalization this represents a significant decrease in medical care costs. However, this estimate is difficult to interpret assuming that HMO enrollees may be healthier and that one might then expect them to having lower lengths of stay. Therefore, this result will be checked using county level data on Medicare hospital days from the ARF.

Individual HMO coverage is positively correlated with the probability of having had any doctor visit in the past two weeks and is negatively correlated with the

probability of having had no doctor visits in the last year. This indicates that individual HMO coverage is associated with increases in the utilization of physician services. This estimate may even understate the positive effect of HMO coverage on doctor visits, if one were to believe that unobserved health status were resulting in the positive selection of healthier seniors into Medicare HMOs. In addition, the negative correlation between individual HMO coverage and the probability of having had no doctor visits in the last year may indicate an improvement of access to medical care and preventive services with HMO coverage. Individual HMO coverage is found to be negatively correlated with the number of hospital days in the last year given that the individual was hospitalized at all in the last year. This result may be indicative of the utilization review aspects of managed care. The combination of the reduced number of hospital days coupled with the reduction in the probability of having had no doctor visit, however, suggests that more preventive care may be leading to less severe illness and shorter hospital stays.

The variable for having a chronic condition is strongly correlated with all of the utilization measures. This is potentially problematic due to the possible endogeneity of this variable. For example, seniors may be more likely to report having a chronic condition after having had a doctor visit. All of the models were estimated without the variable for chronic conditions, and the results for $MMCO_{st}$ and $HMOCOV_i$ were similar to those reported in Table 5.

Of interest to this paper is to identify the effects of Medicare managed care penetration and individual HMO coverage on medical care utilization for sensitive groups of the elderly population: the poor and those with chronic conditions. Table 6 displays results of OLS regressions of the utilization measures on the variables of interest

interacted with indicators for poverty status and the presence of chronic conditions. As in Table 4, the main effects of the variables of interest are in the direction of increased utilization except in the case of hospital lengths of stay.

Table 6 show results including interactions of the managed care variables and indicator for chronic conditions and poverty status. HMO enrollees with chronic conditions are found to have much smaller reductions in the probability of going without a doctor visit than the sample as a whole. In addition, there is some evidence that those with chronic conditions who live in areas with high Medicare managed care penetration are found to have longer hospital length of stays. These two results suggest that gains in access that Medicare HMO penetration has for the entire sample were not extended to seniors with chronic conditions. Gains in access may have accrued largely to healthier seniors. For the poor, those with HMO coverage and those who live in areas with high Medicare managed care penetration are found to be less likely to have had a recent doctor visit versus the rest of the sample. Overall, poor seniors who live in areas with high Medicare managed care penetration experience in an increase in the probability of having had a recent doctor visit.

Since such a high percentage of seniors report having a chronic condition, I estimate the model leaving out the interactions with chronic condition. These results are not reported here; however they differ little from those reported in Table 6. I also estimate the model using a variable for having two or more chronic conditions versus having one or more chronic condition; 43% of the sample reports having two or more chronic conditions. Again the results differ little from those reported in Table 6.

Due to the potential problems of omitted variables bias and measurement error in HMO coverage, the use of instrumental variables was explored. Unfortunately, while several of the proposed instruments were strongly correlated with HMO coverage, none added significantly to the explanatory power of the model. (See Appendix A). Instrumental variables estimates for the utilization model were, therefore, not informative because of their large standard errors. Given the inclusion of state dummy variables, the instrumental variables did not display enough within-state variation to be useful. It may then be the case that the reported OLS estimates of the effect of individual HMO coverage on utilization are understated. In addition, high R-squareds (around .95) in first stage regressions of Medicare managed care penetration are coupled with highly significant state fixed effects. This suggests that omitted variables may only minimally bias estimates for Medicare managed care penetration given the inclusion of state fixed effects in OLS regressions for utilization.

In summary, individual data from the NHIS show that both individual HMO coverage and Medicare HMO penetration increase the probability of recent doctor visits and reduce the probability of seniors' having had no doctor visits. Since the selection of healthier individuals into Medicare HMOs should reduce utilization, these results may be viewed as true effects and may even be understated. Individual HMO coverage is also found to decrease the percentage of visits to specialists and to reduce the number of days hospitalized. If Medicare HMO enrollees are healthier than the rest of the elderly population, then these last two results may be biased. County level data from the ARF, which should be freer of selectivity issues, will be used to verify these last two results.

V.B. Results from the ARF

Table 7 provides regression results for both the utilization measures and physician supply measures from the ARF. These regressions are run using county fixed effects. In none of the estimations did private managed care penetration affect utilization or physician supply; however, this may be due to measurement error in the calculation of county level HMO enrollments from Interstudy data. Medicare managed care penetration was found to affect both utilization and physician supply. Medicare managed care penetration has no effect on the overall number of Medicare hospital discharges yet decreases the number of Medicare hospital days at the county level. These results are largely consistent with those obtained from the NHIS where Medicare managed care was found to have no effect on hospitalization rates yet individual HMO coverage was found to decrease the number of days hospitalized. From the ARF, an increase of 2 percentage points in MMCO, such as that which occurred between 1995 and 1996, would lead to a reduction in hospital days per Medicare beneficiary of .0584. Given a mean number of Medicare hospital days of 2.45, this represents a 2.4% reduction in hospital days. From the NHIS, having HMO coverage would lead to a reduction in hospital days of 1.08. Given an increase of .02 in the probability of HMO coverage, this implies a reduction of 2.2% in hospital days overall. The difference between the two estimates of the reduction in hospital days is small and is likely due to measurement error in the NHIS and not omitted variables bias. (One would expect unobserved health status in the NHIS to lead to healthier HMO enrollees and therefore bias estimates of a reduction in hospital days further downward).

Estimates of the effect of Medicare managed care penetration on physician supply show that Medicare managed care penetration has no effect on the overall supply of specialists per capita and pediatricians per capita. Since pediatricians per capita is used as a control these results show that Medicare managed care is not spuriously correlated with physician supply. Medicare managed care penetration is found to reduce the number of cardiologists per capita. Given a mean number of cardiologists per 1000 population of .07, a 2 percentage point increase in Medicare managed care penetration would cause a .5% reduction in the number of cardiologists per 1000 population. This reduction may be due to declining demand for cardiologist services as Medicare managed care restricts access to specialists relevant to the elderly. Results from the NHIS show that those with Medicare HMO coverage have a lower percentage of specialist visits, although this estimate may be biased downward by the positive selection of healthier seniors into Medicare HMOs. Results for specialist supply from the ARF, which should be free of selectivity bias, coupled with results from the NHIS on specialists visits suggest that Medicare managed care may have some negative effect on access to specialists.

VI. Conclusions

Individual Medicare HMO coverage is found to increase the usage of outpatient doctor services by the elderly while decreasing the number of days spent hospitalized. Results using county level data reinforce the results for the number of days spent hospitalized. Individual Medicare HMO coverage is positively correlated with having

had any doctor's visits in the last year. This result taken in conjunction with the reduction in hospital days may indicate that more preventive care may be the cause of the reduction in hospital days. The Medicare managed care penetration rate is found to increase the probability of recent doctor visits as well as reducing the probability of having gone without any doctor visits. Positive effects of HMO coverage and Medicare managed care penetration on outpatient doctor services were estimated despite the potential problems of positive selection and measurement error, which would tend to bias the effects downward. Individual HMO coverage was found to reduce specialist visits and county level data showed that increased Medicare managed care penetration reduces the supply of cardiologists, specialists who work primarily with the elderly. Since both individual HMO coverage and Medicare HMO penetration were found to reduce the probability of going without any doctor visits, this suggests that managed care improves access to medical care. Results for specialist visits and for the supply of specialists, however, suggest that access to specialists may have been reduced by the growth of Medicare managed care.

For those with chronic conditions, Medicare managed care penetration increases the number of days spend hospitalized while individual HMO coverage reduces the probability of going without a doctor visit, but for less than for the rest of the sample. For low-income seniors, those with HMO coverage or who live in areas with higher Medicare HMO penetration are found to have a lower probability of having had a recent doctor visit versus the rest of the sample. The results for the poor and for those with chronic conditions suggest that these groups did not gain as much in terms of access to care and utilization as did the rest of the elderly population.

Overall, managed care is found to increase the usage of outpatient services while decreasing the usage of inpatient services. Managed care may have improved access to care. Furthermore, since both individual HMO coverage as well as Medicare managed care market penetration were found to affect medical care utilization, this suggests that the growth of Medicare managed care has had spillover effects onto the utilization of medical care for all seniors, not just for those with HMO coverage.

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Appendix A

Several potential instrumental variables presented themselves and appeared promising based on their strong correlations with the Medicare managed care penetration rate and the individual HMO coverage variables. None of the proposed instruments was significantly correlated with the utilization measures and all should be independent of the potential source of omitted variables bias, unobserved health status. Unfortunately, none of the proposed instruments added significantly to the explanatory power of the first stage regressions, and instrumental variables estimations using them where uninformative because of the large standard errors for the variables of interest. First stage estimates for two proposed instruments (the private managed care penetration rate and the Medicare managed care penetration rate) are shown in Appendix Table 1.

The first instrument proposed is the private managed care penetration rate. This variable is strongly correlated with both the Medicare managed care penetration rate as well as individual HMO coverage. This strong correlation is expected because greater penetration of HMOs in the private managed care market provides more competition for patients as well as a greater number of health plans which might offer Medicare risk contracts. The private managed care penetration rate may be excluded, however, from the utilization regressions in that the health care market for the working age population need not directly influence utilization for the elderly. In fact, in utilization regressions estimated with private managed care penetration as a regressor, no statistically significant correlation was found between private managed care penetration and any of the

utilization measures. This proposed instrument adds little explanatory power to the first stage regressions.

The second instrument proposed is the Medicare managed care penetration rate at the time the sampled individual turned 65. Seniors just turning 65 have 6 months to choose a Medigap plan with a premium determined without regard to their health status. After this time period, they may pay considerably higher Medigap premia. In addition, 65 year olds typically choose whether to purchase Medicare Part B coverage. Since 65 year olds are making decisions about their health insurance coverage, one might expect the Medicare managed care penetration rate when they turn 65 to be correlated with their health insurance status. The Medicare managed care penetration rate at age 65, however, should not be correlated with current medical care utilization. As in the case of private managed care penetration, this proposed instrument adds little explanatory power to the first stage regressions.

Other potential instruments were also attempted with similar results. Two of these are veteran status and whether the state had a waiver in effect mandating managed care enrollment for Medicaid recipients. Veteran.status confers different health insurance options through the VA system. Whether the state had a waiver in effect mandating managed care enrollment may be positively correlated with the willingness of managed care plans to offer coverage to public health insurance beneficiaries in general.

In general, despite the low added explanatory value of the proposed instrumental variables, the R-squareds in the first stage regressions for the Medicare managed care penetration rate are very high (around .95). This explanatory power is coming from state fixed effects. This suggests that OLS estimation of the coefficients on the Medicare

managed care penetration rate in the utilization equations, which include state fixed effects, may be subject only to a small amount of omitted variables bias, if any.

Table 1 - The Percentage of Medicare Beneficiaries Enrolled in Managed Care

State	1989	1992	1993	1994
AK	0.0%	0.0%	0.0%	0.0%
AL	0.0%	0.0%	0.0%	0.3%
AR	0.0%	0.0%	0.0%	0.0%
AZ	5.6%	16.4%	23.0%	26.6%
CA	18.2%	23.9%	27.5%	31.1%
CO	10.4%	11.4%	12.2%	16.0%
CT	0.4%	2.2%	2.3%	2.4%
DC	9.4%	10.4%	10.5%	10.0%
DE	0.0%	0.0%	0.0%	0.0%
FL	9.4%	12.8%	13.3%	14.9%
GA	0.0%	0.0%	0.3%	0.3%
HI	27.4%	27.9%	29.6%	31.0%
IA	2.1%	2.1%	2.0%	2.0%
ID	0.0%	0.0%	0.0%	0.0%
IL	4.3%	5.3%	5.5%	5.8%
IN	1.6%	1.0%	1.4%	1.4%
KS	3.0%	2.7%	2.6%	2.5%
KY	0.3%	0.6%	0.5%	0.5%
LA	0.0%	0.0%	0.0%	0.4%
MA	3.0%	3.7%	5.2%	6.4%
MD	0.1%	0.9%	1.0%	1.3%
ME	0.0%	0.0%	0.0%	0.0%
MI	1.0%	0.6%	0.6%	0.6%
MN	10.1%	21.1%	20.1%	19.0%
MO	1.9%	3.6%	3.7%	3.9%
MS	0.0%	0.0%	0.0%	0.0%
MT	0.0%	0.0%	0.0%	0.0%
NC	0.0%	0.3%	0.4%	0.4%
ND	0.5%	0.6%	0.7%	0.7%
NE	1.6%	1.4%	1.4%	1.3%
NH	0.0%	0.0%	0.0%	0.0%
NJ	1.0%	1.3%	2.2%	2.5%
NM	6.0%	8.5%	9.2%	13.6%
NV	7.1%	10.2%	15.7%	19.5%
NY	5.2%	5.3%	6.2%	6.9%
OH	1.5%	1.6%	1.6%	1.7%
OK	0.0%	1.0%	1.3%	1.6%
OR	18.6%	20.9%	25.1%	28.2%
PA	0.7%	1.0%	1.5%	2.7%
RI	1.2%	8.9%	10.7%	9.9%
SC	0.0%	0.0%	0.0%	0.0%
SD	0.0%	0.0%	0.0%	0.0%
TN	0.0%	0.0%	0.0%	0.0%
TX	0.8%	1.8%	2.6%	4.4%
UT	0.7%	3.6%	6.7%	16.1%
VA	0.0%	0.0%	0.0%	0.2%
VT	0.0%	0.0%	0.0%	0.0%
WA	8.5%	9.3%	9.7%	10.8%
WI	1.3%	1.2%	1.3%	1.4%
WV	2.5%	2.6%	2.5%	2.4%
WY	0.0%	0.0%	0.0%	0.0%
Total	4.5%	6.0%	6.9%	7.9%

Source: HCFA

Table 2 - Descriptive Statistics from the NHIS for Seniors (Age 65+)

	All N = 39442		Medicare HMO Coverage ($HMOCOV_i$=1) N = 4706		Chronic Conditions N = 26915		Poverty N = 4229	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Utilization measures:								
No doctor's visits last 12 months	0.127	(.002)	0.095	(.004)	0.072	(.002)	0.152	(.006)
Doctor's visits last 12 months	6.510	(.095)	6.031	(.308)	8.349	(.137)	8.284	(.365)
Doctor's visits last 12 months if any[1]	7.454	(.108)	6.667	(.339)				
Any doctor's visit last 2 weeks	0.243	(.002)	0.256	(.007)	0.327	(.003)	0.256	(.007)
Any hospitalizations last 12 months	0.165	(.002)	0.148	(.005)	0.212	(.003)	0.193	(.007)
Hospital days last 12 months if any[2]	10.481	(.201)	9.122	(.513)	10.993	(.225)	10.912	(.542)
Specialist Visits/All visits last 2 weeks[3]	0.417	(.005)	0.410	(.015)	0.428	(.005)	0.320	(.015)
Insurance coverage:								
Medicare	0.950	(.001)	0.916	(.004)	0.957	(.001)	0.942	(.004)
Medicare Part A[4]	0.964	(.001)	0.963	(.004)	0.967	(.001)	0.948	(.004)
Medicare Part B[5]	0.925	(.002)	0.908	(.005)	0.930	(.002)	0.926	(.005)
No Medicare	0.043	(.001)	0.082	(.004)	0.036	(.001)	0.033	(.003)
Both Medicare and Medicaid	0.054	(.001)	0.014	(.002)	0.065	(.002)	0.269	(.007)
Private	0.785	(.002)	1.000	(.000)	0.776	(.003)	0.404	(.008)
Medicaid	0.060	(.001)	0.016	(.002)	0.072	(.002)	0.294	(.007)
Uninsured	0.009	(.001)	0.000	(.000)	0.007	(.001)	0.019	(.002)
Managed Care:								
Individual managed care coverage	0.107	(.002)	1.000	(.000)	0.105	(.002)	0.043	(.003)
Medicare managed care penetration rate ($\%MMCO_{st}$)	0.063	(.000)	0.126	(.002)	0.062	(.001)	0.043	(.001)
Overall HMO penetration rate ($\%PMCO_{st}$)	0.214	(.000)	0.257	(.001)	0.213	(.001)	0.187	(.001)
Health Status:								
Has a chronic condition	0.682	(.002)	0.664	(.007)	1.000	(.000)	0.764	(.007)
Any activity limitation	0.377	(.003)	0.334	(.007)	0.553	(.003)	0.517	(.008)
Reported health status - excellent	0.167	(.002)	0.201	(.006)	0.113	(.002)	0.090	(.005)
Reported health status - very good	0.235	(.002)	0.240	(.007)	0.196	(.003)	0.169	(.006)
Reported health status - fair	0.185	(.002)	0.170	(.006)	0.239	(.003)	0.278	(.007)
Reported health status - poor	0.084	(.001)	0.056	(.003)	0.120	(.002)	0.168	(.006)
Demographics:								
Male	0.432	(.003)	0.475	(.008)	0.425	(.003)	0.264	(.007)
Black	0.072	(.001)	0.060	(.003)	0.075	(.002)	0.215	(.006)
Hispanic	0.038	(.001)	0.048	(.003)	0.037	(.001)	0.080	(.004)
Married	0.589	(.003)	0.665	(.007)	0.566	(.003)	0.251	(.007)
Veteran	0.268	(.002)	0.314	(.314)	0.260	(.003)	0.096	(.005)
High school drop-out	0.388	(.003)	0.286	(.007)	0.411	(.003)	0.717	(.007)
Some college	0.268	(.002)	0.343	(.007)	0.257	(.003)	0.068	(.004)
Highest family educ: high school drop-out	0.007	(.000)	0.169	(.006)	0.008	(.001)	0.040	(.003)
Highest family educ: some college	0.989	(.001)	0.465	(.008)	0.987	(.001)	0.936	(.004)
Family size	1.944	(.005)	1.979	(.014)	1.916	(.006)	1.682	(.020)
Reference person	0.693	(.002)	0.686	(.007)	0.707	(.003)	0.860	(.006)
Other reference person - male	0.247	(.002)	0.252	(.007)	0.236	(.003)	0.104	(.005)
Other reference person - female	0.058	(.001)	0.060	(.004)	0.056	(.001)	0.034	(.003)
Number of adult family members	1.864	(.004)	1.911	(.011)	1.839	(.005)	1.498	(.013)
Central City	0.261	(.002)	0.346	(.007)	0.256	(.003)	0.312	(.007)
Rural	0.018	(.001)	0.009	(.001)	0.017	(.001)	0.022	(.002)
Economic Status:								
Below poverty	0.099	(.002)	0.038	(.038)	0.111	(.002)	1.000	(.000)
Income < $10k	0.185	(.002)	0.101	(.005)	0.206	(.003)	0.935	(.004)
$10k <= Income < $20k	0.302	(.002)	0.285	(.007)	0.309	(.003)	0.063	(.004)
$20k <= Income < $30k	0.187	(.002)	0.224	(.006)	0.185	(.003)	0.003	(.001)
$30k <= Income < $40k	0.094	(.002)	0.110	(.005)	0.091	(.002)	0.000	(.000)
$40k <= Income < $50k	0.055	(.001)	0.075	(.004)	0.053	(.001)	0.000	(.000)
Income >= $50k	0.090	(.002)	0.111	(.005)	0.080	(.002)	0.000	(.000)
Age 65-69	0.335	(.003)	0.392	(.007)	0.315	(.003)	0.264	(.007)
Age 70-74	0.280	(.002)	0.287	(.007)	0.271	(.003)	0.245	(.007)
Age 75-79	0.195	(.002)	0.179	(.006)	0.203	(.003)	0.206	(.007)
Age 80-84	0.116	(.002)	0.095	(.004)	0.128	(.002)	0.168	(.006)
Age 85+	0.073	(.001)	0.047	(.003)	0.085	(.002)	0.117	(.005)

Sources: NHIS 1989, 1992-94; HCFA.
Data have been weighted to national totals.

[1] Number of obs. = 34395, 4243, 24948, and 3578, respectively.

[2] Number of obs. = 6478, 692, 5688, and 803, respectively.

[3] Number of obs. = 9325, 1063, 8592, and 1024, respectively.

[4] Medicare Part A for 1993 and 1994 only. Number of obs. = 25700, 1366, 17638, and 2636, respectively.

[5] Medicare Part B for 1993 and 1994 only. Number of obs. = 25636, 1358, 17588, and 2621, respectively.

Table 3 - Descriptive Statistics - Area Resource File

	All counties		Counties with any Medicare Discharges	
	Mean	S.E.	Mean	S.E.
Medicare managed care penetration rate	0.140	(.007)	0.142	(.007)
Private managed care penetration rate	0.221	(.005)	0.223	(.005)
Medicare hospital discharges per beneficiary	0.328	(.005)	0.338	(.005)
Medicare hospital days per beneficiary	2.450	(.044)	2.527	(.045)
Specialists per 1000 pop.	0.800	(.024)	0.810	(.024)
Cardiologists per 1000 pop.	0.069	(.002)	0.070	(.002)
Pediatricians per 1000 pop.	0.162	(.004)	0.164	(.004)
Per capita income in $1000s	24.245	(.221)	24.372	(.224)
% age 65-74	0.074	(.000)	0.074	(.001)
% age 75-84	0.045	(.000)	0.045	(.000)
% age 85+	0.015	(.000)	0.015	(.000)
% over 65 female	0.565	(.002)	0.565	(.002)
% over 65 black	0.079	(.003)	0.079	(.003)
% over 65 other race	0.063	(.004)	0.064	(.004)
Doctors/1000	0.002	(.000)	0.002	(.000)
Hospital beds/1000	0.004	(.000)	0.004	(.000)
Urban	0.798	(.008)	0.806	(.007)
Rural	0.024	(.001)	0.017	(.001)
N	9228		8060	

Data have been weighted to national totals.
Data sources: Area Resource File 1999, Census Bureau, HCFA, Interstudy.

Table 4 - Insurance Coverage Regressions

	Dependent Variables					
	$HMOCOV_i$		$HMOCOV_i$		$MMCO_{st}$	
N = 39442	Est.	S.E.	Est.	S.E.	Est.	S.E.
Medicare managed care penetration rate	0.417	(.154) ***				
Demographics:						
Has a chronic condition	0.006	(.003) **	0.006	(.003) **	0.000	(.000)
Below poverty	-0.023	(.006) ***	-0.023	(.006) ***	0.000	(.000)
Any activity limitation	-0.011	(.004) ***	-0.011	(.004) ***	0.000	(.000)
Reported health status: excellent	0.001	(.006)	0.002	(.006)	0.001	(.000) *
Reported health status: very good	-0.004	(.004)	-0.004	(.004)	0.001	(.000) **
Reported health status: fair	0.002	(.004)	0.002	(.004)	0.000	(.000)
Reported health status: poor	-0.014	(.007) **	-0.015	(.007) **	-0.001	(.000) **
Male	-0.004	(.005)	-0.004	(.005)	0.001	(.000) **
Black	0.011	(.007)	0.011	(.007)	0.000	(.000)
Hispanic	-0.015	(.016)	-0.015	(.016)	-0.001	(.001)
Married	0.034	(.006) ***	0.034	(.006) ***	0.000	(.000)
Veteran	0.001	(.005)	0.001	(.005)	-0.001	(.000) **
High school drop-out	-0.007	(.005)	-0.007	(.005)	0.000	(.000) *
Some college	0.007	(.006)	0.007	(.006)	0.001	(.000) **
Highest family educ: high school drop-out	-0.009	(.006)	-0.009	(.006)	0.000	(.000)
Highest family educ: some college	0.001	(.005)	0.000	(.005)	-0.001	(.000)
Family size	-0.010	(.004) **	-0.010	(.004) **	0.000	(.000)
Reference person	0.048	(.033)	0.047	(.033)	-0.003	(.001) **
Other reference person - male	0.011	(.032)	0.010	(.032)	-0.003	(.001) **
Other reference person - female	0.006	(.035)	0.004	(.035)	-0.003	(.001) *
Number of adult family members	-0.002	(.006)	-0.002	(.005)	0.000	(.000)
Income < $10k	-0.003	(.008)	-0.003	(.007)	0.001	(.001)
$10k <= Income < $20k	0.012	(.005) **	0.012	(.005) **	0.000	(.001)
$20k <= Income < $30k	0.024	(.006) ***	0.024	(.006) **	0.000	(.001)
$30k <= Income < $40k	0.011	(.008)	0.011	(.008)	0.000	(.001)
$40k <= Income < $50k	0.030	(.011) ***	0.030	(.011) ***	0.000	(.001)
Income >= $50k	-0.003	(.008)	-0.003	(.009)	0.000	(.001)
Age 65-69	0.045	(.006)	0.045	(.006) ***	0.000	(.000)
Age 70-74	0.028	(.006) ***	0.028	(.006) ***	0.000	(.000)
Age 75-79	0.021	(.006) ***	0.021	(.006) ***	0.000	(.000)
Age 80-84	0.017	(.006) ***	0.017	(.006) ***	0.000	(.000)
Central City	0.035	(.007) ***	0.035	(.007) ***	0.000	(.000)
Rural	0.002	(.012)	0.002	(.012)	0.000	(.000)
R^2	0.090		0.090		0.950	

Notes: Regressions were run using OLS with standard errors corrected for heteroskedasticity.
Additional dummy variables for age, season, year, and state were included.
***Significant at the 99% level. ** Significant at the 95% level. *Significant at the 90% level.

Table 5 - Utilizations Regressions

	No doctor's visits last 12 months		Log(Doctor's visits last 12 months, if any)		Any doctor's visits last 2 weeks		% Specialist visits last 2 weeks		Any hospital visit last 12 months		Log(# of hospital days last 12 months, if hospitalized)	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Managed care variables:												
HMO coverage ($HMOCOV_i$)	-0.033	(.004) ***	-0.054	(.020) ***	0.016	(.006) **	-0.037	(.017) ***	-0.002	(.007)	-0.101	(.044) **
Medicare managed care penetration rate	-0.122	(.061) **	-0.149	(.219)	0.230	(.093) **	-0.030	(.198)	-0.071	(.076)	-0.102	(.436)
Demographics:												
Has a chronic condition	-0.176	(.005) ***	0.688	(.011) ***	0.267	(.004) ***	0.162	(.020) ***	0.142	(.004) ***	0.367	(.035) ***
Below poverty	0.016	(.007) **	0.029	(.024)	-0.002	(.009)	-0.014	(.018)	-0.009	(.008)	-0.024	(.048)
Male	0.049	(.006) ***	-0.006	(.019)	-0.022	(.007) ***	0.019	(.017)	0.028	(.007) ***	0.112	(.045) **
Black	-0.016	(.007) **	0.092	(.021) ***	0.024	(.009) ***	-0.063	(.016) ***	-0.010	(.007)	0.060	(.054)
Hispanic	-0.007	(.009)	0.055	(.025) **	0.008	(.011)	-0.028	(.028)	-0.002	(.010)	-0.016	(.062)
Married	-0.042	(.005) ***	-0.027	(.016) *	0.021	(.006) ***	0.052	(.014) ***	-0.005	(.006)	-0.032	(.035)
Veteran	0.009	(.005) *	-0.001	(.015)	0.009	(.007)	0.021	(.016)	0.009	(.007)	0.004	(.039)
High school drop-out	-0.002	(.006)	0.044	(.018) **	-0.002	(.008)	-0.033	(.017) **	0.016	(.007) **	0.064	(.040)
Some college	-0.005	(.006)	0.033	(.020) *	0.012	(.009)	0.018	(.019)	0.002	(.007)	-0.064	(.043)
Highest family educ: high school drop-out	0.017	(.006) ***	-0.008	(.020)	-0.006	(.007)	-0.026	(.020)	-0.005	(.006)	-0.001	(.045)
Highest family educ: some college	-0.011	(.006) *	-0.011	(.016)	0.000	(.007)	0.042	(.018) **	-0.001	(.007)	0.038	(.042)
Family size	0.004	(.004)	0.032	(.015) **	-0.005	(.006)	-0.005	(.012)	0.010	(.004) ***	0.033	(.033)
Reference person	-0.151	(.047) ***	0.073	(.124)	0.014	(.055)	0.154	(.107)	0.089	(.033) ***	1.295	(.253) ***
Other reference person - male	-0.125	(.047) ***	0.071	(.125)	-0.006	(.055)	0.142	(.108)	0.086	(.034) **	1.309	(.252) ***
Other reference person - female	-0.158	(.048) ***	0.103	(.130)	0.011	(.056)	0.170	(.108)	0.104	(.034) ***	1.263	(.255)
Number of adult family members	0.009	(.006)	0.005	(.020)	-0.002	(.007)	-0.024	(.018)	-0.004	(.006)	0.048	(.042)
Income < $10k	0.034	(.009) ***	0.147	(.029) ***	0.012	(.012)	-0.009	(.024)	0.028	(.008) ***	0.116	(.065) *
$10k <= Income < $20k	0.018	(.008) **	0.079	(.022) ***	0.008	(.009)	0.017	(.022)	0.005	(.006)	0.096	(.057) *
$20k <= Income < $30k	0.004	(.008)	0.046	(.022) **	0.005	(.009)	0.023	(.022)	0.002	(.006)	0.036	(.060)
$30k <= Income < $40k	-0.004	(.008)	0.095	(.024) ***	0.029	(.011) ***	0.057	(.025) **	0.008	(.008)	0.006	(.060)
$40k <= Income < $50k	-0.008	(.010)	0.073	(.027) ***	0.021	(.013)	0.055	(.028) **	0.004	(.009)	-0.165	(.072) **
Income >= $50k	-0.025	(.008) ***	0.053	(.025) **	0.026	(.011) **	0.061	(.029) **	-0.003	(.008)	-0.116	(.070) *
Age 65-69	0.045	(.007) ***	-0.095	(.023) ***	-0.011	(.010)	0.040	(.016) **	-0.053	(.009) ***	-0.194	(.053) ***
Age 70-74	0.015	(.007) **	-0.031	(.024)	0.004	(.010)	0.062	(.017) ***	-0.037	(.009) ***	-0.126	(.057) **
Age 75-79	0.009	(.007)	0.012	(.025)	0.015	(.009) *	0.074	(.018) ***	-0.013	(.010)	-0.108	(.059) *
Age 80-84	-0.008	(.008)	-0.005	(.026)	0.005	(.010)	0.040	(.021) *	-0.016	(.010) *	-0.086	(.055)
Central City	0.002	(.004)	0.009	(.015)	-0.004	(.005)	0.020	(.013)	-0.005	(.004)	0.057	(.032) *
Rural	-0.013	(.017)	-0.064	(.051)	-0.007	(.016)	0.038	(.042)	-0.006	(.010)	-0.027	(.085)
R^2	0.075		0.122		0.090		0.054		0.043		0.051	
N	39442		34395		39442		9325		39442		6465	

Notes: Regressions were run using OLS with standard errors corrected for heteroskedasticity.
Additional dummy variables for season, year, and state were included.
***Significant at the 99% level. ** Significant at the 95% level. *Significant at the 90% level.

Table 6 - Utilizations Regressions with Interactions

	No doctor's visits last 12 months		Log(Doctor's visits last 12 months, if any)		Any doctor's visits last 2 weeks		% Specialist visits last 2 weeks		Any hospital visit last 12 months		Log(# of hospital days last 12 months, if hospitalized)	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Managed care variables:												
HMO coverage ($HMOCOV_i$)	-0.058	(.013) ***	-0.060	(.027) **	0.008	(.006)	0.012	(.044)	0.008	(.006)	-0.047	(.105)
HMO coverage*chronic condition	0.040	(.015) ***	0.015	(.040)	0.014	(.010)	-0.060	(.049)	-0.015	(.011)	-0.064	(.116)
HMO coverage*below poverty	-0.041	(.027)	-0.084	(.065)	-0.058	(.033) *	0.116	(.096)	0.007	(.029)	0.064	(.173)
Medicare managed care penetration rate	-0.170	(.069) **	-0.267	(.224)	0.264	(.103) **	-0.022	(.286)	-0.043	(.075)	-0.680	(.534)
Medicare managed care penetration rate*chronic condition	0.074	(.048)	0.195	(.112) *	-0.027	(.067)	0.001	(.237)	-0.042	(.035)	0.710	(.321) **
Medicare managed care penetration rate*below poverty	-0.035	(.099)	-0.278	(.258)	-0.199	(.096) **	-0.105	(.153)	0.023	(.075)	-0.427	(.654)
Demographics:												
Has a chronic condition	-0.185	(.006) ***	0.674	(.013) ***	0.267	(.005) ***	0.170	(.023) ***	0.147	(.005) ***	0.332	(.044) ***
Below poverty	0.020	(.008) **	0.047	(.028) *	0.010	(.010)	-0.015	(.020)	-0.010	(.010)	-0.006	(.051)
Male	0.049	(.006) ***	-0.005	(.018)	-0.022	(.007) ***	0.019	(.017)	0.028	(.007) ***	0.112	(.044) **
Black	-0.016	(.007) **	0.091	(.021) ***	0.023	(.009) ***	-0.063	(.016) ***	-0.010	(.007)	0.058	(.054)
Hispanic	-0.007	(.009)	0.056	(.024) **	0.009	(.011)	-0.026	(.028)	-0.002	(.010)	-0.013	(.061)
Married	-0.042	(.005) ***	-0.027	(.016) *	0.021	(.006) ***	0.052	(.014) ***	-0.005	(.006)	-0.033	(.035)
Veteran	0.009	(.005) *	-0.001	(.015)	0.009	(.007)	0.021	(.016)	0.009	(.007)	0.004	(.039)
High school drop-out	-0.002	(.006)	0.044	(.018) **	-0.002	(.008)	-0.033	(.017) **	0.016	(.007) **	0.066	(.041)
Some college	-0.005	(.006)	0.033	(.020) *	0.012	(.009)	0.018	(.019)	0.002	(.007)	-0.061	(.043)
Highest family educ: high school drop-out	0.017	(.006) ***	-0.009	(.020)	-0.006	(.007)	-0.026	(.020)	-0.005	(.006)	-0.003	(.046)
Highest family educ: some college	-0.011	(.006) **	-0.011	(.016)	0.000	(.007)	0.042	(.018) **	-0.001	(.007)	0.036	(.043)
Family size	0.004	(.004)	0.033	(.015) **	-0.005	(.006)	-0.005	(.012)	0.010	(.004) ***	0.034	(.032)
Reference person	-0.151	(.047) ***	0.071	(.124)	0.013	(.055)	0.155	(.108)	0.089	(.033) ***	1.298	(.254) ***
Other reference person - male	-0.125	(.047) ***	0.069	(.124)	-0.007	(.055)	0.143	(.110)	0.086	(.034) **	1.312	(.253) ***
Other reference person - female	-0.158	(.048) ***	0.100	(.130)	0.010	(.055)	0.171	(.110)	0.105	(.034) ***	1.264	(.256) ***
Number of adult family members	0.009	(.006)	0.005	(.020)	-0.002	(.007)	-0.025	(.018)	-0.004	(.006)	0.047	(.042)
Income < $10k	0.034	(.009)	0.148	(.029) ***	0.012	(.012)	-0.009	(.024)	0.028	(.008) ***	0.116	(.064) *
$10k <= Income < $20k	0.019	(.008) ***	0.080	(.022) ***	0.008	(.009)	0.016	(.022)	0.005	(.006)	0.097	(.057) *
$20k <= Income < $30k	0.004	(.008) **	0.046	(.022) **	0.005	(.009)	0.023	(.022)	0.002	(.006)	0.035	(.059)
$30k <= Income < $40k	-0.004	(.008)	0.095	(.024) ***	0.029	(.011) ***	0.056	(.025)	0.008	(.008)	0.005	(.059)
$40k <= Income < $50k	-0.008	(.010)	0.073	(.027) ***	0.021	(.013)	0.055	(.028) **	0.004	(.009)	-0.166	(.072) **
Income >= $50k	-0.025	(.008) ***	0.053	(.025) **	0.025	(.011) **	0.061	(.029) *	-0.003	(.008)	-0.117	(.069) *
Age 65-69	0.046	(.007) ***	-0.095	(.023) ***	-0.011	(.010)	0.041	(.017) **	-0.053	(.009) ***	-0.193	(.054) ***
Age 70-74	0.015	(.007) **	-0.031	(.024)	0.004	(.010)	0.062	(.017) **	-0.037	(.008) ***	-0.126	(.057) **
Age 75-79	0.009	(.007)	0.012	(.025)	0.015	(.009) *	0.074	(.018) ***	-0.013	(.010)	-0.108	(.060) *
Age 80-84	-0.008	(.008)	-0.005	(.027)	0.005	(.010)	0.040	(.021) ***	-0.016	(.010) *	-0.087	(.056)
Central City	0.002	(.004)	0.009	(.015)	-0.004	(.005)	0.021	(.013)	-0.005	(.004)	0.057	(.032) *
Rural	-0.013	(.017)	-0.065	(.051)	-0.007	(.016)	0.037	(.042)	-0.006	(.010)	-0.025	(.086)
R^2	0.076		0.122		0.090		0.055		0.043		0.051	
N	39442		34395		39442		9325		39442		6465	

Notes: Regressions were run using OLS with standard errors corrected for heteroskedasticity.
Additional dummy variables for season, year, and state were included.
***Significant at the 99% level. ** Significant at the 95% level. *Significant at the 90% level.

Table 7 - Regressions Results from the ARF

	Medicare hospital discharges per Medicare beneficiary		Medicare hospital days per Medicare beneficiary		Specialists per 1000 pop.		Cardiologists per 1000 pop.		Pediatricians per 1000 pop.	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Medicare managed care penetration rate	-0.043	(.074)	-2.920	(1.107) ***	0.023	(.040)	-0.017	(.007) ***	0.018	(.012)
Private managed care penetration rate	-0.027	(.035)	-0.162	(.527)	0.004	(.023)	0.000	(.004)	0.000	(.007)
Per capita income	0.002	(.002)	0.065	(.028) **	0.006	(.002) ***	0.000	(.000)	0.001	(.000) *
% age 65-74	3.556	(1.565) **	-12.008	(23.355)	0.415	(.745)	0.022	(.124)	0.903	(.225) ***
% age 75-84	-5.152	(2.639) *	25.832	(39.376)	1.217	(1.427)	0.194	(.238)	0.062	(.431)
% age 85+	-4.535	(6.299)	-324.595	(94.009) ***	0.662	(3.413)	-0.544	(.569)	-2.221	(1.031) **
% over 65 female	-0.292	(.961)	-2.095	(14.342)	0.302	(.551)	-0.175	(.092)	0.323	(.166) *
% over 65 black	-0.192	(1.146)	-15.621	(17.105)	1.133	(.650) *	-0.062	(.108)	0.103	(.196)
% over 65 other race	1.924	(1.051) *	10.718	(15.687)	1.323	(.615) **	-0.135	(.103)	0.465	(.186) **
Doctors/1000	20.324	(13.263)	919.276	(197.930) ***						
Hospital beds/1000	3.269	(.873) ***	103.709	(13.022) ***						
Year dummy (1996=1)	0.007	(.004) *	-0.039	(.064)						
Year dummy (1997=1)					0.022	(.005) ***	0.002	(.001) **	0.008	(.001) **
R^2	0.005		0.046		0.023		0.025		0.052	
N	4958		4958		6117		6117		6117	

Notes: Regressions were run including county fixed effects.
***Significant at the 99% level. ** Significant at the 95% level. *Significant at the 90% level.

Appendix Table 1 - First Stage Regressions with Proposed Instrumental Variables

	Dependent Variables											
	$HMOCOV_i$		$HMOCOV_i$		$HMOCOV_i$		$MMCO_{st}$		$MMCO_{st}$		$MMCO_{st}$	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Proposed Instrumental Variables:												
Private managed care penetration rate			0.260	(.092) ***					0.146	(.073) **		
Medicare managed care penetration rate at age 65					0.251	(.236)					0.349	(.088) ***
Demographics:												
Has a chronic condition	-0.001	(.003)	-0.001	(.003)	-0.011	(.006) *	0.000	(.000)	0.000	(.000)	0.000	(.000) **
Below poverty	-0.023	(.006) ***	-0.023	(.006) ***	-0.028	(.017) *	0.000	(.000)	0.000	(.000)	0.000	(.001)
Male	-0.004	(.004)	-0.004	(.004)	-0.003	(.012)	0.000	(.000)	0.000	(.000)	0.001	(.000) **
Black	0.010	(.006)	0.010	(.006)	0.034	(.015) **	0.000	(.000)	0.000	(.000)	0.000	(.000)
Hispanic	-0.015	(.017)	-0.015	(.017)	0.009	(.021)	-0.001	(.001)	-0.001	(.001)	-0.002	(.001) ***
Married	0.034	(.007) ***	0.034	(.007) ***	0.031	(.014) **	0.000	(.000)	0.000	(.000)	0.000	(.000)
High school drop-out	-0.008	(.005)	-0.008	(.005)	-0.003	(.011)	0.000	(.000) *	0.000	(.000) *	0.001	(.000) **
Some college	0.007	(.005)	0.007	(.005)	0.003	(.010)	0.001	(.000) **	0.001	(.000) **	0.001	(.000)
Highest family educ: high school drop-out	-0.009	(.006)	-0.009	(.006)	-0.017	(.011)	0.000	(.000)	0.000	(.000)	-0.001	(.001) **
Highest family educ: some college	0.000	(.005)	0.000	(.005)	0.005	(.012)	-0.001	(.000)	-0.001	(.000)	-0.001	(.001)
Family size	-0.010	(.004)	-0.010	(.004) **	-0.028	(.006) ***	0.000	(.000)	0.000	(.000)	0.000	(.000)
Reference person	0.049	(.033)	0.048	(.033)	0.082	(.082)	-0.003	(.001) *	-0.003	(.001)	0.002	(.002)
Other reference person - male	0.011	(.032)	0.010	(.032)	0.035	(.075)	-0.003	(.001) *	-0.003	(.001)	0.002	(.002)
Other reference person - female	0.005	(.035)	0.005	(.035)	0.028	(.078)	-0.003	(.001) *	-0.003	(.001)	0.001	(.002)
Number of adult family members	-0.002	(.005)	-0.002	(.005)	0.015	(.010)	0.000	(.000)	0.000	(.000)	0.000	(.001)
Income < $10k	-0.005	(.008)	-0.005	(.008)	-0.052	(.022) **	0.001	(.001)	0.001	(.001)	0.001	(.001)
$10k <= Income < $20k	0.011	(.005)	0.011	(.005) **	-0.003	(.014)	0.000	(.001)	0.000	(.001)	0.000	(.001)
$20k <= Income < $30k	0.024	(.006) ***	0.024	(.006) ***	0.020	(.015)	0.000	(.001)	0.000	(.001)	-0.001	(.001)
$30k <= Income < $40k	0.011	(.008)	0.011	(.008) ***	0.033	(.015) **	0.000	(.001)	0.000	(.001)	0.001	(.001)
$40k <= Income < $50k	0.030	(.011) ***	0.030	(.011) ***	0.053	(.019) ***	0.000	(.001)	0.000	(.001)	-0.001	(.001)
Income >= $50k	-0.003	(.008)	-0.003	(.009)	0.001	(.016)	0.000	(.001)	0.000	(.001)	0.000	(.001)
Age 65-69	0.046	(.006) ***	0.046	(.006) ***			0.000	(.000)	0.000	(.000)	-0.006	(.002) ***
Age 70-74	0.030	(.006) ***	0.030	(.006) ***	-0.008	(.013)	0.000	(.000)	0.000	(.000)		
Age 75-79	0.022	(.006) ***	0.022	(.006) ***			0.000	(.000)	0.000	(.000)		
Age 80-84	0.018	(.007) ***	0.018	(.007) ***			0.000	(.000)	0.000	(.000)		
Central City	0.035	(.007) ***	0.035	(.007) ***	0.044	(.010) ***	0.000	(.000)	0.000	(.000)	0.001	(.000) **
Rural	0.002	(.012)	0.002	(.012)	-0.021	(.020)	0.000	(.000)	0.000	(.000)	0.000	(.001)
R^2	0.089		0.089		0.100		0.950		0.951		0.975	
N	39442		39442		10148		39442		39442		10148	

Notes: Regressions were run using OLS with standard errors corrected for heteroskedasticity.
Additional dummy variables for age, season, year, and state were included.
***Significant at the 99% level. ** Significant at the 95% level. *Significant at the 90% level.